

4 Development of Remedial Action Objectives and General Response Actions

This section defines several key cleanup concepts common to all feasibility studies prepared in accordance with CERCLA rules and guidance:

- Remedial action objectives,
- Applicable or relevant and appropriate requirements (ARARs) and information that is “to be considered” (TBC) in the development of remedial alternatives, and
- General response actions (GRAs).

Collectively, these concepts set the stage for developing effective and protective remedial alternatives for cleaning up the Lower Fox River and Green Bay.

RAOs are general cleanup objectives designed to protect human health and the environment. RAOs for the Lower Fox River and Green Bay address the threats site contaminants pose to human and ecological receptors. Risks to biological receptors were characterized and estimated in the BLRA (Section 3).

ARARs and TBCs constitute the body of existing statutes, regulations, ordinances, guidance, and published reports pertaining to any and all aspects of a potential cleanup action in the Lower Fox River and Green Bay. This information typically influences the development of remedial alternatives insofar as the establishment of numeric cleanup levels, permitting, siting, disposal, operating parameters, health and safety, and monitoring. The remedial alternatives developed in Section 7 must, to the extent practicable, meet the requirements of ARARs and address the findings of TBCs.

Lastly, this section presents GRAs for the Lower Fox River and Green Bay. GRAs are broad categories of actions such as treatment, containment, disposal, or combinations of the various categories designed to satisfy one or more of the RAOs. The remedial alternatives developed in Section 7 of this report are a synthesis of the applicable remedial technologies identified in Section 6 and the GRAs presented here.

4.1 Media and Chemicals of Concern

Defining the media and chemicals of concern (COCs) in the Lower Fox River and Green Bay is a necessary prerequisite to developing site-specific RAOs and GRAs. RAOs often state what media (e.g., surface water, soil, sediments) must be targeted for cleanup in order to protect human health and the environment. GRAs are also specific to the media and COCs insofar as the physical actions (e.g., removal, disposal) and treatment processes that should be considered. Finally, ARARs and TBC information are generally specified based on media and COCs. For example, identifying surface water as a medium of concern triggers consideration of state and federal clean water regulations.

4.1.1 Media of Concern

The RI identified surface water and sediments as the media of concern in the Lower Fox River and Green Bay. Contamination to these media pose risks to human health and ecological receptors. The BLRA (Section 3) determined that the sediments have the greatest impact on improving surface water quality, and thus on reducing risks to humans and wildlife. GRAs presented later in this section describe general cleanup options for COCs contained in sediments only. Cleanup of surface water and reductions in fish tissue COC concentrations will occur naturally once the source of contamination to surface water (i.e., impacted sediments) is removed, treated, or contained.

The vast majority of the mass of COCs is sorbed to sediment particles and is transported through the Fox River and Green Bay in suspended solids. Thus, water quality improvements of the two water bodies must focus on the reservoir of COCs contained in the sediment deposits.

4.1.2 Chemicals of Concern

Investigations of sediment and water quality coupled with information on former process operations along the Lower Fox River identified over 300 potential contaminants in the Lower Fox River (WDNR, 1993). *The Lower Green Bay Remedial Action Plan 1993 Update for the Lower Green Bay and Fox River Area of Concern* (WDNR, 1993) and the *Screening Level Risk Assessment* (RETEC, 1998) narrowed this list to eight COPCs for evaluation in the Baseline Risk Assessment (RETEC, 2002b) as follows:

- **COPCs**
 - ▶ PCBs (total and/or Aroclor 1242, PCB coplanar congeners),
 - ▶ Dioxins (2,3,7,8-TCDD),
 - ▶ Furans (2,3,7,8-TCDF),
 - ▶ DDT and metabolites (DDE and DDD),
 - ▶ Dieldrin,

- ▶ Arsenic,
- ▶ Lead, and
- ▶ Mercury.

A detailed examination of these eight organic and inorganic constituents in the BLRA (Section 3) determined that PCBs pose the greatest human and ecological health risks in both surface water and sediments of the Lower Fox River and Green Bay. Mercury is the single inorganic constituent that presents significant risks. The BLRA also determined that DDE is a concern in sediments and that the risks from this constituent are confined to Green Bay. The COCs identified in the BLRA (RETEC, 2002b) and carried forward in the FS evaluation include:

- **COCs**
 - ▶ PCBs (total and coplanar congener),
 - ▶ Mercury, and
 - ▶ DDE.

However, PCBs are the dominant contributor to risks at the site as a whole. The remedial alternatives developed in this FS focus on the cleanup of sediments containing PCBs at levels considered a threat to human and ecological receptors.

4.2 Remedial Action Objectives for Lower Fox River and Green Bay

Protection of human health and the environment in the Lower Fox River and Green Bay can be achieved through fulfillment of the five RAOs discussed below and summarized in Table 4-1.

4.2.1 Surface Water Quality

RAO 1: Achieve, to the extent practicable, surface water quality criteria throughout the Lower Fox River and Green Bay.

RAO 1 addresses the impacts contaminated sediments in the Lower Fox River and Green Bay have on surface water quality. The primary focus of this FS is on management of sediments. The principal measure of management and/or cleanup success is achieving protective levels of COCs in fish tissue (see Sections 4.2.2 and 4.2.3) as determined in the BLRA. For this reason, water quality criteria are TBCs for all COCs in this FS. However, WDNR recognizes the importance of meeting, to the extent physically practicable, project ARARs and surface water quality TBCs for all COCs. The standards and criteria associated with ARARs and TBCs are discussed in Section 4.3.1. For relative comparison purposes between different remedial alternatives in this FS, expected surface water quality

in 30 years following remedy completion is compared to Wisconsin state surface water quality for protection of human and wildlife health.

4.2.2 Human Health Risks

RAO 2: Protect humans who consume fish from exposure to COCs that exceed protective levels.

The BLRA determined that human exposure to PCBs through ingestion of fish is the exposure pathway leading to the greatest potential for adverse human health effects. Reducing levels and/or exposures of COCs in sediments is the most important means of reducing levels in fish residing in the Lower Fox River and Green Bay. The BLRA also identified ingestion of resident waterfowl by hunters as a significant exposure pathway. However, the health effects associated with this exposure pathway are less than those associated with ingestion of fish. Meeting the RAO for anglers will also protect hunters.

Several key thresholds were carried forward in the FS for relative comparison between alternatives. These thresholds were selected by both WDNR and EPA as important risk evaluation criteria that relate to the human health RAOs for the project:

- Achieve protective levels in 10 years following cleanup for recreational anglers - walleye, whole fish, RME, HI is 1.0 (noncancer) (288 $\mu\text{g}/\text{kg}$);
- Achieve protective levels in 10 years following cleanup for recreational anglers - walleye, whole fish, RME, 10^{-5} cancer risk (106 $\mu\text{g}/\text{kg}$);
- Achieve protective levels in 30 years following cleanup for high-intake fish consumers - walleye, whole fish RME, HI is 1.0 (noncancer) (181 $\mu\text{g}/\text{kg}$); and
- Achieve protective levels in 30 years following cleanup for high-intake fish consumers - walleye, whole fish, RME, 10^{-5} cancer risk (71 $\mu\text{g}/\text{kg}$).

Because many of the recreational angler thresholds are met within 30 years following cleanup without implementation of an active remedy, the high-intake fish consumer threshold was added to the comparative analysis.

WDNR and EPA have established a remedy expectation that recreational anglers will be able to safely consume fish within 10 years following remedy completion,

and high-intake fish consumers will be able to safely eat fish within 30 years following remedy completion.

4.2.3 Ecological Risks

RAO 3: Protect ecological receptors from exposure to COCs above protective levels.

The BLRA established exposure pathways and risks to multiple ecological receptors. At greatest risk from exposure to COCs (primarily PCBs) are:

- The insects and other organisms that live in the sediments and form the base of the food chain;
- Fish; and
- Birds and mammals that rely principally on fish for food.

The BLRA also concluded that reducing levels of COCs or exposures in surface sediments is the most important means of reducing risks to wildlife in the Lower Fox River and Green Bay. WDNR and EPA have established a remedy expectation that safe ecological thresholds will be consistently met within 30 years following remedy completion.

Several key thresholds were carried forward in the FS for relative comparison between alternatives. These thresholds were selected by both WDNR and EPA as important risk evaluation criteria that relate to the ecological health RAOs for the project:

- Achieve protective levels in 30 years following cleanup based on carnivorous bird deformity - NOAEC based on carp, whole fish (121 $\mu\text{g}/\text{kg}$);
- Achieve protective levels in 30 years following cleanup based on protection of piscivorous mammals (mink) - NOAEC based on carp, whole fish (50 $\mu\text{g}/\text{kg}$); and
- Achieve surface water quality for the protection of wildlife (0.12 ng/L) in 30 years following cleanup.

4.2.4 Transport of Contaminants to Lake Michigan

RAO 4: Reduce transport of PCBs from the Lower Fox River into Green Bay and Lake Michigan.

Contaminant transport from the Lower Fox River to Green Bay and greater Lake Michigan is detrimental to environmental quality in these aquatic systems. Dissolved-phase COCs are transported downstream and along prevailing currents in the water column. Similarly, the movement of COCs adsorbed to resuspended sediments is a concern, particularly during high-flow periods. This RAO is designed to improve environmental conditions in the Lower Fox River and Green Bay as well as in Lake Michigan. The performance evaluation of remedial actions must consider the long-term transport of residual COCs and the potential such transport has to cause adverse human and ecological health effects. For relative comparison purposes between different remedial alternatives in this FS, the PCB loading rates onto Green Bay at the mouth of the Lower Fox River are compared to the combined loading rates of other Green Bay tributaries following remedy completion in the Lower Fox River.

4.2.5 Contaminant Releases During Remediation

RAO 5: Minimize the downstream movement of PCBs during implementation of the remedy.

This RAO focuses attention on the short-term effectiveness of remedial alternatives. Contaminant releases may occur through various mechanisms, such as volatilization or sediment resuspension (i.e., during dredging). Achieving the goals of this RAO may require incorporation of measures to control contaminant releases during remediation.

4.3 Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBC) Information

Section 121(d) of CERCLA stipulates that remedial actions instituted under the Superfund program comply with ARARs. Consideration must also be given to relevant information that, while not legally binding, is collectively referred to as TBC information. ARARs are promulgated cleanup standards and other environmental protection requirements, criteria, or limitations contained within local, state, and federal laws and regulations. TBCs may or may not be promulgated standards and not legally enforceable. Nevertheless, TBCs may contribute to the development and implementation of effective and protective remedial alternatives.

The identification of ARARs and TBCs depends on the media, COCs, site-specific characteristics, and the technologies employed during remediation. ARARs and TBCs that may contribute to defining remedial alternatives for the Lower Fox

River are provided in Tables 4-2 and 4-3 and are grouped into chemical-specific, location-specific, and action-specific categories.

4.3.1 Chemical-specific ARARs and TBCs

Chemical-specific ARARs define concentration limits for environmental media. These requirements may be used to set cleanup levels for COCs in sediment and water. For example, the Federal Clean Water Act establishes concentration limits in surface water that are considered protective of human and aquatic life. The principal chemical-specific ARARs and TBCs for sediment cleanup in the Lower Fox River and Green Bay are:

- **Toxic Substances Control Act (TSCA).** TSCA is both a chemical and action ARAR that establishes federal requirements for handling, storage and disposal of materials containing PCBs in excess of 50 ppm.
- **Federal Clean Water Act.** Ambient water quality criteria developed under the Clean Water Act are non-enforceable guidelines that identify protective concentrations of various chemical constituents for surface waters. As non-enforceable guidelines, the ambient water quality criteria are TBCs for the site.
- **State of Wisconsin Water Quality Standards - WAC NR 100 Series.** Wisconsin Administrative Code (WAC) Sections NR 102 through 105 establishes surface water quality standards for the state. The standards are used in making water management decisions and in the control of municipal, business, land development, and agricultural discharges. The WAC NR 140 establishes groundwater quality standards for the state. These standards are used for managing upland disposal facilities. These standards are ARARs for water quality criteria that must be achieved following sediment remediation work in the Lower Fox River and Green Bay. Water quality ARARs related to point discharges are covered under action-specific ARARs.

With respect to establishing sediment cleanup levels, WDNR's sediment guidance (WDNR, 1996) states that state water quality standards are goals to be considered in the development and evaluation of sediment cleanup actions. They are not to be used to develop sediment cleanup values. Although the WDNR's water quality criteria (WQC) are legally promulgated standards, they are not legally enforceable since WDNR does not have a promulgated method for establishing sediment cleanup standards derived from WQC. Protective sediment COC concentrations for the Lower Fox River and Green Bay were developed in the BLRA as discussed in Section 3. This approach is supported by EPA's 1996

Superfund PCB cleanup guidance (EPA, 1996a) which allows for the calculation and use of risk-based sediment cleanup levels as opposed to levels calculated based on equilibrium partitioning between sediments and the overlying water column. Thus, the water quality standards are TBCs for sediment remediation in the Lower Fox River and Green Bay.

4.3.2 Location-specific ARARs

Location-specific ARARs place constraints or define requirements for remedial activities that occur in environmentally sensitive areas (e.g., wetlands, floodplains). Location-specific ARARs are used to manage the disposal of sediment-derived wastes in the State of Wisconsin and out-of-state landfills (i.e., preservation of historical sites, navigational constraints). In addition, this category of ARARs defines the siting and permitting requirements for new treatment and disposal facilities (e.g., landfills). The principal location-specific ARARs and TBCs for sediment cleanup in the Lower Fox River and Green Bay are:

- **Wisconsin Statutes Chapter 289.** Prohibits the construction of landfill facilities in floodplains or in open-water areas except by special state permits or legislative authority. Also manages the landfill siting and approval process for upland disposal.
- **Wisconsin Statutes Chapter 30.** Regulates work performed in navigable waters and harbors.

4.3.3 Action-specific ARARs

Action-specific ARARs govern the design, performance, or operational aspects of contaminated materials management. For example, action-specific ARARs are used to establish safe concentration levels for discharge of materials during implementation of a remedial action. The National Pollution Discharge Elimination System (NPDES) defines concentration limits on water discharged to surface water from industrial facilities and operations. Discharge limitations would likely apply to sediment cleanups involving the dredging and subsequent discharge of dredge water to surface water. The principal action-specific ARARs and TBCs for sediment cleanup in the Lower Fox River and Green Bay are:

- **State of Wisconsin WAC NR 500 through 520.** These regulations are ARARs that establish standards for collection, handling, transport, storage, and disposal of solid wastes, respectively. These disposal standards apply for both new and existing landfills. Under Wisconsin law, dredged material is considered a solid waste.

- **State of Wisconsin WAC NR 600.** These regulations are ARARs that establish standards for handling and management of hazardous wastes. These disposal standards apply for both new and existing hazardous waste landfills. The NR 600 series would also include hazardous waste management using high-temperature thermal desorption (HTTD) and incinerator units.
- **State of Wisconsin WAC NR 500 and Wisconsin Statute 289.43.** These regulations contain exemptions for the management of solid and low-hazard wastes.
- **State of Wisconsin WAC NR 400.** These regulations are ARARs that establish air quality standards for removal and disposal of hazardous waste. They also set allowable chemical concentration levels for removal and disposal of contaminated sediments. Treatment of sediments by HTTD units would be managed as incinerators under this series by air quality, if TSCA-level materials are treated.
- **State of Wisconsin WAC NR 200 (WPDES program).** These regulations establish water quality effluent limits for discharges during sediment remediation activities. The dewatering ponds/lagoons used for temporary dewatering of dredged material would likely be managed as a wastewater lagoon under the WAC NR 200 series. The WAC NR 213 regulation specifically addresses the requirements for lining of industrial lagoons and design of storage structures regarding effluent limits.
- **Wisconsin Statutes Chapter 30.** This section of the Wisconsin Statutes contains provisions to minimize adverse effects on navigable waterways. The statute specifically bans open-water disposal of dredged material on the beds of navigable waters unless a permit is granted by WDNR pursuant to the statute or the state legislature specifically authorizes an open-water disposal project. It does not, however, prohibit construction of a nearshore confined disposal facility (CDF) and disposal of dredged sediments (less than 50 ppm PCBs) into a newly constructed CDF.
- **Wisconsin Statutes Chapter 289 (Low-hazard Waste Exemption).** This section of the Wisconsin Statutes addresses the permitting and siting requirements for construction of new upland landfills and disposal of solid waste along a river. Under this statute, WDNR has the authority to waive setback requirements for siting disposal facilities.

The low-hazard exemption statute could be used for non-TSCA dredged material disposal sites if no impact to the surrounding environment can be justified.

- **Section 10 - Rivers and Harbors Act.** This federal statute contains provisions for minimizing adverse effects from dredge and fill work conducted within navigable waterways of the United States.
- **Section 404 - Clean Water Act.** This ARAR requires approval from the USACE for discharges of dredge or fill materials into waters of the United States.
- **Federal Clean Water Act.** Surface water quality standards under Section 304 of the Clean Water Act are ARARs for point discharges to the river. Discharges occurring as a part of sediment remediation must comply with this ARAR.

4.3.4 To Be Considered Information

TBCs can be grouped into chemical-, location-, or action-specific categories. Important laws, regulations, and guidance that are TBCs for the cleanup of sediments in the Lower Fox River and Green Bay are as follows:

- **State of Wisconsin Surface Water Quality Standards.** The state water quality standards are TBCs for evaluating the effectiveness of sediment remedial alternatives. One of the RAOs for site cleanup is meeting these standards to the extent practicable.
- **Federal Safe Drinking Water Act.** As with water quality standards, drinking water standards are TBCs for sediment cleanup in the Lower Fox River and Green Bay. RAO 1 requires that remedial alternatives meet drinking water standards to the extent practical. These standards are not used to develop sediment cleanup levels.
- **Great Lakes Water Quality Agreement.** This agreement calls for the identification of “Areas of Concern” and the establishment of remedial goals for impacted ports, harbors, and river mouths in the Great Lakes area.
- **Section 303(d) - Clean Water Act.** This portion of the Clean Water Act requires states to formulate and submit to EPA lists of “impaired waterways” that may be subject to watershed planning with respect to total maximum daily loads (TMDL) of various water quality

parameters. In December 1996, WDNR submitted its first list of impaired waterways to EPA, which included the Fox River because of the presence of PCBs.

- **Sediment Remediation Implementation Guidance.** Part of the 1995 Strategic Directions Report prepared by WDNR addresses how sediment remediation work should be approached in the State of Wisconsin. The guidance calls for using a risk management process to appraise environmental impacts and assess the technical feasibility and costs of sediment remediation, and states that water quality standards are goals for evaluating sediment impacts to the aquatic environment and for evaluating the performance of various remedial options.
- **Great Lakes Water Quality Initiative.** This initiative sets forth guidance to states bordering the Great Lakes regarding wastewater discharge programs. For remedial actions involving discharges, any lowering of water quality should be minimized to the extent practicable. These concepts are embodied in WAC NR 102 through 106.

4.3.5 Numeric Surface Water and Drinking Water TBCs

Table 4-4 lists drinking water and surface water quality standards and criteria for the eight COPCs identified in the SLRA. PCBs, DDE, and mercury are the primary COCs that pose a risk to human health and the environment with respect to impairment of water quality. These values are goals (RAO 1) for ambient water quality following sediment cleanup and ARARs with respect to limiting point discharges during remediation.

4.4 Development of General Response Actions (GRAs)

The RAOs, in conjunction with results of the RI and BLRA, establish the basis for identifying general response actions to clean up the Lower Fox River and Green Bay. GRAs are broad categories of actions such as treatment, containment, disposal, or combinations of the various categories. Specific categories of GRAs identified for contamination in the Lower Fox River and Green Bay sediments are as follows:

- No Action,
- Institutional Controls,
- Monitored Natural Recovery,
- Containment,
- Removal,

- *In-situ* Treatment,
- *Ex-situ* Treatment, and
- Disposal.

4.4.1 Description of GRAs

No Action

Consideration of a “No Action” response is required by the National Contingency Plan (NCP). No action serves as a baseline against which the performance of other remedial alternatives can be compared. This response assumes no active remedial measures are implemented.

Institutional Controls

Institutional controls are legal or administrative measures designed to restrict site access or limit site use. The measures reduce exposure to COCs by precluding activities that could lead to exposure. Dredging moratoriums and fish consumption advisories are relevant examples of institutional controls.

Monitored Natural Recovery

Natural recovery refers to the processes by which concentrations of COCs in impacted media decline over time by natural processes such as biodegradation, burial, or dilution. While both mercury and PCBs are persistent in the sediment environment, reductions in the concentrations of these constituents over time will occur as a result of these natural processes. However, the time frame required to achieve sufficient reductions in bioavailable concentrations must be calculated and it must be determined whether the time frame is reasonable and acceptable. As discussed in the next section of this report (Section 5), the assumption of natural recovery is central to the development of a range of sediment cleanup action levels that can be used to evaluate varying cleanup time frames for the proposed alternatives.

Containment

Containment involves the physical isolation and immobilization of contaminants in sediment. Capping is a common method used in lakes, bays, marine, and riverine environments for containing impacted sediments. No sediment treatment occurs other than by natural processes under the cap surface. Assuming effective cap placement, the bioavailability and mobility of contaminants present in the sediments would be immediately limited.

Removal

Sediment removal by dredging or excavation is another common practice for managing contaminated sediments. Following removal, the material is usually

relocated to a treatment or disposal facility. Dredging often requires consideration of other unit processes such as:

- In-water controls to minimize contaminant resuspension during removal,
- Dewatering to reduce sediment moisture content,
- Treatment of dredge water before discharge, and
- Disposal and/or treatment of dredged material.

***In-situ* Treatment**

In-situ treatment involves chemical or biological methods for reducing contaminant concentrations or bioavailability without first removing the sediment.

***Ex-situ* Treatment**

Ex-situ treatment involves the application of treatment technologies to transform, destroy or immobilize COCs following removal of the contaminated sediments. Thermal destruction is one of the more common treatment technologies for PCBs and other chlorinated organics. Metals are commonly treated with cement or other stabilizing materials.

Disposal

Disposal is the permanent placement of material into an appropriate structure or facility. It is often a significant component of alternatives involving removal of sediments (capacity and cost). Disposal or possible beneficial reuse considerations involve the contaminated media and/or residues from pretreatment and treatment operations.

4.4.2 Summary of GRAs and Expectations

Several of the individual GRAs described above likely would not be implemented alone. Rather, they would be implemented in conjunction with other actions. Final selection and design of GRAs will depend on the technological ability to meet the project expectations described in Table 4-5. These expectations are used in this FS to compare the relative risk reduction, costs, and number of years to reach protective thresholds between different alternatives and action levels. Project expectations are a comparative tool and actual implementation of expectations for management of risks will be determined during the design phase. With respect to sediment remediation, the response actions (or combinations) carried forward in this FS are as follows:

- No action,
- Monitored natural recovery and institutional controls,
- Containment (capping),
- Removal and disposal, and
- Removal and *ex-situ* treatment.

Depending on the level of treatment, ARARs, and the physical composition of sediment, treated material may be beneficially used as fill, precluding disposal in a landfill.

In Section 6 of this FS Report, remedial action technologies are identified and screened for each of the aforementioned response actions. In addition, process options within each technology type are identified and screened. The technology types and process options retained after screening are utilized in the development of remedial alternatives (Section 7) for the Lower Fox River and Green Bay.

4.5 Section 4 Tables

Tables for Section 4 follow this page and include:

Table 4-1	Remedial Action Objectives for the Lower Fox River and Green Bay
Table 4-2	Potential Federal ARARs and TBCs for the Lower Fox River and Green Bay
Table 4-3	Potential State ARARs and TBCs for the Lower Fox River and Green Bay
Table 4-4	Surface Water Quality Criteria
Table 4-5	Remediation Goals and Project Expectations

Table 4-1 Remedial Action Objectives for the Lower Fox River and Green Bay

Number	Definition
1	<i>Achieve, to the extent practicable, surface water quality criteria throughout the Lower Fox River and Green Bay.</i>
2	<i>Protect humans who consume fish from exposure to COCs that exceed protective levels.</i>
3	<i>Protect ecological receptors from exposure to COCs above protective levels.</i> This RAO considers: <ul style="list-style-type: none"> • Adverse effects to the diversity and reproductive viability of aquatic organisms (fish and insects) in the Lower Fox River and Green Bay, • Adverse effects to fish, • Adverse effects to insect-eating birds through ingestion of fish, and • Adverse effects to fish-eating mammals through ingestion of fish.
4	<i>Reduce transport of PCBs from the Lower Fox River into Green Bay and Lake Michigan.</i>
5	<i>Minimize the downstream movement of PCBs during implementation of the remedy.</i>

Table 4-2 Potential Federal ARARs and TBCs for the Lower Fox River and Green Bay

Program	Requirements	Citation	Description	Application	Comment
Clean Water Act		33 U.S.C.A. Sec. 1251-1387			
	Ambient Water Quality Criteria	CWA Section 304 Quality Criteria for Water, EPA, 1986	Establishes non-enforceable guidelines for States to set water quality standards for surface water. Criteria based on protection of aquatic life and human health.	Chemical	Applicable only if concentrations of surface water above sediments exceed these criteria; otherwise becomes a cross-media check.
	Water Quality Standards	CWA Section 303 40 CFR 131	Requires states to develop water quality standards based on federal guidelines.	Chemical Action	Applicable only if concentrations of surface water above sediments exceed these criteria; otherwise becomes a cross-media check.
	National Pollutant Discharge Elimination System	CWA Section 401	Requires compliance with permit limitations for discharge to navigable waters, including water quality effluent limits, water quality standards, national performance standards, and toxic and pretreatment effluent standards.	Action	NPDES program is administered by the state. (see Wisconsin NPDES Permit Regulations.) Applicable for actions involving discharges of liquid effluent to surface water.
	Effluent Standards - Technology- Based Discharge Requirements	CWA Section 301(b)	Requires all direct discharges to be treated with best control technology prior to discharge.	Action	Applicable if surface water is channeled directly to a surface water body via a ditch, culvert, storm sewer, or other means; or treated water is discharged.
	Dredge and Fill Requirements	CWA Section 404 (Inland Testing Manual)	Regulates discharge of dredged or fill material to U.S. waters, including wetlands. Testing manual establishes procedures for determining the potential for contaminant-related impacts associated with discharge of dredged material in inland waters.	Action	Applicable for consideration of any practicable alternatives and may require protection of environmental values of the site.
	Proposed Sediment Quality Criteria	CWA Section 304 Sediment Quality Criteria, EPA, 1991	Establishes sediment quality standards that will not unacceptably affect benthic organisms.	Chemical	Potentially applicable once promulgated.
	Great Lakes Critical Program Act of 1990 - Assessment and Remediation of Contaminated Sediments (ARCS) Program	CWA Section 118 (c)(7) 40 CFR Part 132 (Appendix E)	Provide environmental managers at AOCs and elsewhere with the tools and information necessary for making informed cost-effective, and environmentally sound decisions in addressing a local contaminated sediment problem.	Location	To be considered in addressing existing and possible pollutant problems in the Great Lakes and their tributaries.

Table 4-2 Potential Federal ARARs and TBCs for the Lower Fox River and Green Bay (Continued)

Program	Requirements	Citation	Description	Application	Comment
Resource Conservation and Recovery Act		42 U.S.C.A. 6901–6992k			
	General Requirements	40 CFR Parts 172 and 173	Establishes standards for transporting PCB waste.	Action	Applicable in evaluating transportation and handling of PCB-dredged material.
	Definition of Hazardous Waste	40 CFR 261	Defines threshold levels and criteria to determine whether material is hazardous waste.	Chemical Action	Applicable in evaluating which wastes would be classified hazardous. These regulations do not set cleanup standards, but would apply during various remedial actions.
Water Resources Development Act					
	Toxic Substances Control Act (TSCA)	40 CFR Parts 750 and 761	Establishes requirements for handling, storage, and disposal of PCB-containing materials in excess of 50 ppm.	Chemical Action	Applicable to alternatives that address PCB-containing materials in excess of 50 ppm
		40 CFR Part 761	Establishes performance standards for disposal technologies (i.e., incinerators, capping).	Action	Air emissions from incineration cannot exceed 0.001 gram of PCBs per kilogram of PCBs treated.
	Occupational Safety and Health Administration (OSHA)	29 CFR Parts 1910.120, 1910.132, 1910.134, 1910.138	Establishes 8-hour time-weighted average concentrations for protection of worker breathing zones, PPE requirements, medical monitoring requirements, respiratory protection requirements, HAZMAT training requirements.	Action	Applicable for workers near areas of contamination
Clean Air Act		42 U.S.C. 7401–7642			
	National Primary and Secondary Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Establishes ambient air quality standards for protection of public health.	Chemical Action	Applicable in evaluating air impacts prior to or during remediation
	National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61	Establishes emission standards for sources emitting benzene, arsenic, asbestos, beryllium, mercury, radionuclides, and vinyl chloride.	Chemical Action	Applicable in evaluating emission standards on treatment technologies.
International Joint Commission (IJC)		IJC, 1992	Protection of fish tissue	Location	To be Considered
Land Disposal of PCB Sediments		Valdas Adamkus 1/24/95 EPA Memorandum to WDNR	Outlines requirements for disposal of PCB sediments greater than 50 mg/kg within Wisconsin NR 500-licensed landfills.	Action	Applicable in evaluating disposal options of sediments. This requirement is being renegotiated as of December 2000.

Table 4-3 Potential State ARARs and TBCs for the Lower Fox River and Green Bay

Program	Requirements	Citation	Description	Application	Comment
Wisconsin State Environmental Protection Administrative Code					
<i>General</i>		<i>WAC NR 100 Series</i>			
	Water Quality Standards for Wisconsin Surface Waters	WAC NR 102–105	Establishes definition of water use and criteria for protection of public health and enjoyment and protection and propagation of fish, shellfish, and wildlife.	Chemical	Applicable only if concentrations of surface water above sediments exceed these criteria. They are TBCs.
	Groundwater Quality	WAC NR 140	Establishes groundwater quality standards for substances detected or having reasonable probability of entering groundwater resources.	Chemical	Applicable for removal, transport, and disposal of contaminated sediments (impacts to groundwater).
	Management of PCBs and Products Containing PCBs	WAC NR 157	Establishes procedures for the storage, collection, transportation, processing, and final disposal of PCBs and materials containing PCBs at any level. It refers to NR 500 and 600 series.	Action	Applicable for removal, transport, and disposal of contaminated sediments.
	Plans and Specifications Review of Projects and Operations	WAC NR 108	WDNR approval of any reviewable project, general operation and control of specific water/wastewater system.	Action	Applicable for community water systems, sewage systems, and industrial wastewater facilities.
<i>WPDES</i>		<i>WAC NR 200 Series</i>			
	Wisconsin Pollutant Discharge Elimination System	WAC NR 200	Technology-based effluent limits (NR 220–297). Requires compliance with permit limitations for discharge to navigable waters, including water quality effluent limits, water quality standards, national performance standards, and toxic and pretreatment effluent standards.	Action	Applicable action-specific ARAR for remedial alternatives involving discharges.
	Water Quality Antidegradation	WAC NR 207	Establish implementation procedures for the antidegradation policy in s. NR 102.05(1)(a).	Action	Applicable to proposed new or increased discharges.
	Water Quality Antidegradation: Waste Load Allocated, Water Quality-related Effluent Standards and Limitations	WAC NR 212–220	Establishes permit limitations for effluent discharges.	Action	Applicable for remedial alternatives involving effluent discharges.
	Lining of Industrial Lagoons and Design of Storage Structures	WAC NR 213	Requires compliance with permit limitations for discharge to navigable waters from industrial treatment systems.	Action	Potentially applicable for waste management of temporary sediment dewatering and treatment systems.

Table 4-3 Potential State ARARs and TBCs for the Lower Fox River and Green Bay (Continued)

Program	Requirements	Citation	Description	Application	Comment
<i>Water Regulation</i> Wisconsin's General Permit Program for Certain Water Regulatory Permits		<i>WAC NR 300 Series</i> WAC NR 322	Establishes minimum design standards and specifications for projects permitted under a general permit.	Action	Potentially applicable for implementation of a given remedial alternative.
Dredging Contract Fees		WAC NR 346	Establishes procedures applicable to the removal of material from the beds of natural lakes and outlying waters for which a contract is required between the state and person desiring to remove bed material.	Action	Potentially applicable for removal, transport, and disposal of sediments.
Sediment Sampling and Analysis, Monitoring Protocol, and Disposal Criteria for Dredging Projects		WAC NR 347	Establishes procedures and protocols for sediment sampling and analysis, disposal criteria, and monitoring requirements for dredging projects regulated by the State of Wisconsin.	Action	Potentially applicable for removal, transport, and disposal of sediments.
<i>Air Pollution Control</i> Wisconsin State Air Pollutant Control Regulations		<i>WAC NR 400 Series</i> WAC NR 400–499	Establishes concentration levels, by chemical, for new sources. Manages construction and operation permits.	Action	Applicable action-specific ARAR for removal and disposal of mercury- and PCB-contaminated sediments.
<i>Solid Waste Management</i> Solid Waste Management		<i>WAC NR 500 Series</i> WAC NR 500–520	Provides definitions, submittal requirements, exemptions and other general information relating to solid waste facilities which are subject to regulations under s. 2789.01(35) Stats. Applicable for off-site siting processes. Applicable to new and existing facilities.	Action	Applicable for implementation of a given remedial alternative.
Beneficial Reuse Solid Waste Exemption		WAC NR 500.08	Establishes criteria for possible beneficial use of solid wastes after treatment. Applies for on-site reuse options only.	Location Action	Applicable for disposal of treated sediments meeting disposal criteria.
<i>Hazardous Waste Management</i> Hazardous Waste Management		<i>WAC NR 600 Series</i> WAC NR 600–685	Provides definitions, general permit application information, incorporation by reference citations and general information concerning the hazardous waste management program. Establishes procedures for handling, storage, and disposal of hazardous wastes.	Action	Applicable for removal, transport, and disposal of contaminated sediments. Applicable to treatment units, regulated as incinerators.
Identification and Listing of Hazardous Waste		WAC NR 605	Establishes criteria for identifying the characteristics of hazardous waste to determine if the waste is subject to regulation.	Action	Applicable for removal, transport, and disposal of contaminated sediments.

Table 4-3 Potential State ARARs and TBCs for the Lower Fox River and Green Bay (Continued)

Program	Requirements	Citation	Description	Application	Comment
<i>Investigation and Remediation of Environmental</i>		<i>WAC NR 700 Series</i>			
Investigation and Remediation of Environmental Contamination		WAC NR 700	Management of contaminated soil. Establishes standards and procedures that allow for site-specific flexibility, pertaining to the identification, investigation, and remediation of sites and facilities which are subject to regulation under s. 144.442, 144.76, or 144.77, Stats.	Action	Applicable for implementation of a given remedial alternative.
Notification of the Discharge of Hazardous Substances		WAC NR 706	Notification procedures and responsibilities by discharger of hazardous substances including containment, cleanup, disposal, and restoration.	Action	Applicable for removal, transport, and disposal of contaminated sediments.
Soil Cleanup Standards		WAC NR 720	Allows for the calculation of site-specific risk-based cleanup standards based on the intended reuse of the property. Generally applied to unsaturated material or soils.	Chemical	Likely managed under NR 500. Potentially applicable if dewatered sediment is considered soil after treatment.
Standards for Selecting Remedial Actions		WAC NR 722	Establishes standards for selection of remedial actions. Generally applied to soil cleanup programs.	Chemical	Potentially applicable, but likely managed under NR 500.
Dredge and Fill Requirements		WDNR 1985, 1990	Report of the Technical Subcommittee on Determination of Dredge Material Suitability of In-Water Disposal.	Location Action	To be considered for alternatives involving in-water disposal, such as confined aquatic disposal (CAD).
Lower Green Bay Remedial Action Plan		WDNR, 1993	Mercury limits.	Chemical	To be considered.
Local Permits (building, zoning, other)			Construction in floodplain or wetland and miscellaneous construction activities.	Location	To be considered for implementation of a given remedial alternative.
Great Lakes Water Quality Initiative (GLI)		WAC 102 and 106 EPA 1995	Sets forth guidance for any remedial action in states bordering the Great Lakes. In general, minimize any lowering of water quality to the extent practicable.	Action	To be considered with regard to remedial alternatives involving wastewater discharge.

Table 4-3 Potential State ARARs and TBCs for the Lower Fox River and Green Bay (Continued)

Program	Requirements	Citation	Description	Application	Comment
Wisconsin State Environmental Protection Statutes					
	Sediment Remediation Implementation Guidance	Strategic Directions Report, WDNR 1995	Addresses the sediment remediation approach recommended by WDNR for sediment remediation projects.	Action	To be considered in risk management, technological feasibility and cost.
	Landfill Siting and Approval Process	Wis. Stats. Ch. 289	State statute for solid waste facilities. Addresses the upland disposal of solid waste along with in-river disposal options. Landfill facilities are prohibited from shoreland and floodplain zone areas except by permits issued from WDNR.	Location	Applicable for implementation of any given remedial alternative disposal option.
	Low-hazard Solid Waste Exemption	Wis. Stats. Ch. 289.43	Solid waste law that allows issuance of exemption from siting requirements in NR 500–520. Dredged material may be considered "exempt" after treatment if "new" product is created.	Action	Potentially applicable if <i>ex-situ</i> treatment option is selected.
	Permit in Navigable Waters	Wis. Stats. Ch. 30	State statute for navigable waters, harbors, and navigation. Substantive provisions that address minimizing adverse effects on navigable waterways resulting from work performed.	Location	Applicable for work performed in navigable waterways.
	EPA TSCA Approval Letter for Land Disposal of PCB Sediments	January 24, 1995 (from Valdas Adamkus)	EPA 5-year approval letter allows WDNR to waive disposal requirements in NR 500 landfills and allow disposal of TSCA-level sediments (>50 ppm).	Action	Applicable in evaluating disposal options of sediments. The requirement is being renegotiated with EPA as of December 2000.

Note:

Wisconsin State Administrative Code can be found at website: <http://www.legis.state.wi.us/rsb/code/>. Table 4-3 last updated from website on December 10, 2000.

Table 4-4 Surface Water Quality Criteria

Chemical of Potential Concern	Clean Water Act ¹				Safe Drinking Water Act ² Standards		Wisconsin Surface Water Quality ³	Wisconsin Surface Water (warm water forage, limited forage, and warm water sport fish communities) ³	
	Freshwater CMC ⁴ (µg/L)	Freshwater CCC ⁵ (µg/L)	Human Health for Consumption of Water and Organism (µg/L)	Human Health for Consumption of Organism Only (µg/L)	MCLG (µg/L)	MCL (µg/L)	Wildlife Criteria ³ (µg/L)	Human Threshold Criteria ⁸ (µg/L)	Human Cancer Criteria ⁸ (µg/L)
Total PCBs	NL	0.014	0.00017 ^A	0.00017 ^A	0	0.5	0.00012	—	0.00001
4,4'-DDT	1.1	0.111	0.00059 ^A	0.00059 ^A	—	—	—	0.003	0.00022
4,4'-DDE	—	—	0.00059 ^A	0.00059 ^A	—	—	—	—	—
4,4'-DDD	—	—	0.00083 ^A	0.00084 ^A	—	—	—	—	—
Dioxin (2,3,7,8-TCDD)	—	—	0.000000013 ^A	0.000000014 ^A	0	3.00E-05	3.00E-09	1.10E-07	1.40E-08
Furan (2,3,7,8-TCDF)	—	—	—	—	—	—	—	—	—
Dieldrin	0.24	0.056	0.00014 ^A	0.00014 ^A	NL	NL	—	0.00059	9.10E-06
Arsenic	340	150	0.018 ^A	0.14 ^A	NL	50	—	—	50
Lead	65	2.5	^B	^B	0	TT	—	140	—
Mercury	1.4	0.77	0.050	0.051	2	2	0.00013	0.0015	—

Notes:

"—" - The chemical of concern was not listed.

NL - No criterion listed for the chemical of concern.

TT - Treatment technique, action level 15 µg/L.

¹ National Recommended Water Quality Criteria - Correction. EPA Office of Water, April 1999. EPA 822-Z-99-01.

² Drinking Water Regulations and Health Advisories. EPA Office of Water, October 1996. EPA 822-B-96-002.

³ Wisconsin Department of Natural Resources, Chapter NR 105, Surface Water Quality and Secondary Values for Toxic Substances.

⁴ Criteria Maximum Concentration.

⁵ Criterion Continuous Concentration.

⁶ Maximum Contaminant Level Goal. A nonenforceable concentration of a drinking water contaminant that is protective of adverse human health effects and allows an adequate margin of safety.

⁷ Maximum Contaminant Level. Maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

⁸ Criteria for non-public water supply (µg/L).

^A Criterion based on carcinogenicity of 10⁻⁶ risk.

^B EPA has not calculated human health criterion for this contaminant. However, permit authorities should address this contaminant in NPDES permit actions using the state's existing narrative criteria for toxics.

Table 4-5 Remediation Goals and Project Expectations

Remedial Action Objective	Valued Endpoint Goal	Remediation Goal	Primary Exposure Pathway	Strategic End Goal and Expectation	Monitoring Metrics
<i>FS Section 4</i>		<i>FS Section 5</i>	<i>BLRA Section 3</i>	<i>Long-term Monitoring Plan (Appendix C)</i>	
Achieve Surface Water Quality	We can eat fish and swim in the water.	Reduce exposure pathway in surface sediments by reducing concentrations in surface water.	Respiration in water, dermal contact	Surface water is \leq to levels in upstream areas. Water quality meets state and federal criteria.	<ul style="list-style-type: none"> • Concentrations in surface water
Protect Human Health	We can all eat fish and birds.	Minimize exposure pathway in surface sediments by reducing concentrations in fish.	Direct ingestion of fish and waterfowl with COCs	Lift consumption advisories in 10 years for recreational anglers and 30 years for high-intake fish consumers following remedy completion.	<ul style="list-style-type: none"> • Concentrations in fish tissue • Concentrations in waterfowl tissue
Protect Ecological Receptors	Habitats and populations are healthy and diverse in 30 years.	Minimize exposure pathway by reducing or isolating concentrations in surface sediments.	Direct contact with sediment and surface water; ingestion of sediment, water, and fish	Fish tissue levels meet protective thresholds in 30 years following remedy completion.	<ul style="list-style-type: none"> • Concentrations in fish, bird, and invertebrate tissue • Mink habitat assessment • Bird population and deformity assessment
Reduce PCB Transport from Lower Fox River to Green Bay and to Lake Michigan	Protect downstream habitats and water quality.	Reduce or contain contaminant mass that may mobilize during regular storm events.	Dermal contact or ingestion of fish	Surface water and sediment levels are \leq to upstream areas. Loading estimates to Green Bay are reduced to tributary levels.	<ul style="list-style-type: none"> • Surface sediment levels • Bathymetry • Flow rates and mass balance
Minimize Releases During Active Remediation	Protect downstream habitats.	Contain contaminant mass during remedy implementation through monitoring and physical barriers.	Ingestion of sediment, water, and prey.	<5% of PCBs are transported downstream during remediation.	<ul style="list-style-type: none"> • Concentration in surface water • Concentration in sediment

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